

WHAT IS CLAIMED IS:

1. A throttle valve system of an internal combustion engine, the throttle valve system comprising:

a throttle valve for controlling a flow rate of intake air to be drawn into the engine; and

a throttle body having an outer bore tube and an inner bore tube accommodating the throttle valve so that the throttle valve can open or close, wherein

the throttle valve system is formed with a trapping space between the outer periphery of the inner bore tube and an inner periphery of the outer bore tube for trapping water entering the throttle body, and

the throttle body is formed in double-tube structure, in which the outer bore tube circumferentially surrounds an outer periphery of the inner bore tube and a radial distance between the inner bore tube and the outer bore tube at a certain position differs from the radial distance between the inner bore tube and the outer bore tube at another position.

2. The throttle valve system of the internal combustion engine as in claim 1, wherein

the throttle body is formed in the double-tube structure, in which a central axis of the inner bore tube is deviated from a central axis of the outer bore tube.

3. The throttle valve system of the internal combustion engine as in claim 2, wherein

the trapping space is an annular space formed between the outer periphery of the inner bore tube and the inner periphery of the outer bore tube,

the annular space is separated by a partition wall through an entire circumference, and

the partition wall defines a trapping concavity for trapping the water, which flows in from an upstream side of the throttle valve, at least in a portion of the annular space upstream of the partition wall.

4. The throttle valve system of the internal combustion engine as in claim 1, wherein

the throttle body is formed in the double-tube structure, in which the outer bore tube partially surrounds the inner bore tube and a central axis of the inner bore tube is deviated from a central axis of the outer bore tube.

5. The throttle valve system of the internal combustion engine as in claim 4, wherein

the trapping space is separated by a partition wall extending radially from the outer periphery of the inner bore tube to the outer bore tube, and

the partition wall defines a trapping concavity for trapping the water, which flows in from the upstream side of the throttle valve, at least in a portion of the trapping space upstream of the partition wall.

6. The throttle valve system of the internal combustion engine as in claim 1, wherein

the trapping space is formed by deviating a central axis of the inner bore tube from a central axis of the outer bore tube so that the trapping space is formed in a required size and a position corresponding to a mounting position of the throttle body.

7. The throttle valve system of the internal combustion engine as in claim 1, wherein

the throttle body is formed so that the inner bore tube is formed in the shape of a cylindrical tube and the outer bore tube is formed in the shape of an elliptical tube or an oblong tube.

8. The throttle valve system of the internal combustion engine as in claim 1, wherein

the inner bore tube is inclined with respect to a direction of flow of the intake air.

9. The throttle valve system of the internal combustion engine as in claim 1, wherein

the trapping space is formed in a shape and a size corresponding to a layout of an intake system of a vehicle or a mounting position of the throttle body.

10. The throttle valve system of the internal combustion

engine as in claim 1, wherein

the trapping space has a larger radial width on a side where a flow control valve for a positive crankcase ventilation system or an idling speed control valve is mounted than on another side where the flow control valve or the idling speed control valve is not mounted.

11. The throttle valve system of the internal combustion engine as in claim 1, wherein

the trapping space has a larger radial width on a lower side than on an upper side when the throttle valve system is mounted to the engine.

12. The throttle valve system of the internal combustion engine as in claim 3, wherein

the annular space is formed in a shape and a size corresponding to a layout of an intake system of a vehicle or a mounting position of the throttle body.

13. The throttle valve system of the internal combustion engine as in claim 3, wherein

the annular space has a larger radial width on a side where a flow control valve for a positive crankcase ventilation system or an idling speed control valve is mounted than on another side where the flow control valve or the idling speed control valve is not mounted.

14. The throttle valve system of the internal combustion engine as in claim 3, wherein

the annular space has a larger radial width on a lower side than on an upper side when the throttle valve system is mounted to the engine.

15. The throttle valve system of the internal combustion engine as in claim 3 or 5, wherein

the trapping concavity is formed in a shape and a size corresponding to a layout of an intake system of a vehicle or a mounting position of the throttle body.

16. The throttle valve system of the internal combustion engine as in claim 3 or 5, wherein

the trapping concavity has a larger radial width on a side where a flow control valve for a positive crankcase ventilation system or an idling speed control valve is mounted than on another side where the flow control valve or the idling speed control valve is not mounted.

17. The throttle valve system of the internal combustion engine as in claim 3 or 5, wherein

the trapping concavity has a larger radial width on a lower side than on an upper side when the throttle valve system is mounted to the engine.

18. The throttle valve system of the internal combustion

engine as in claim 1, wherein

the outer bore tube and the inner bore tube partially share a peripheral wall.